**Abstract**

An apparatus and method for measuring the flow velocity of a fluid flowing through a pipe that includes an array of at least two ultrasonic sensor units (with as many as 16 sensor units) disposed at predetermined locations along the pipe. Each sensor unit includes an ultrasonic transmitter and an ultrasonic receiver. Each sensor unit provides a respective signal indicative of a parameter of the transit time or amplitude of the ultrasonic signal propagating between each respective ultrasonic transmitter and ultrasonic receiver. A signal processor defines a convective ridge in the k-$\omega$ plane in response to the ultrasonic signals using an adaptive beamforming algorithm, such as Capon and Music. The signal processor further determines the slope of at least a portion of the convective ridge to determine the flow velocity of the fluid.